UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2007/2008

October/November 2007

REG 265 – Infrastructure Technology
(Teknologi Infrastruktur)

Duration: 3 hours
Masa: 3 jam

Please check that this examination paper consists of **TEN** pages of printed material before you begin the examination.

*Sila pastikan bahawa kertas peperiksaan ini mengandungi **SEPULUH** muka surat yang tercetak sebelum anda memulakan peperiksaan ini.*

Students are allowed to answer all questions in English OR in Bahasa Malaysia.

Pelajar dibenarkan menjawab semua soalan dalam Bahasa Inggeris ATAU Bahasa Malaysia.

Answer **FIVE** questions only.

*Jawab **LIMA** soalan sahaja.*

...2/-

1. (a) You have been assigned to prepare the sewerage system for a layout plan of a proposed residential development. Describe the buffer zone requirement for this type of development.

Anda telah ditugaskan untuk menyediakan sistem pembetungan bagi satu pelan tatatur cadangan sebuah pembangunan residensi. Bincangkan keperluan zon penampan bagi pembangunan jenis ini.

(5 marks/*markah*)

(b) With the aid of a process flow chart, discuss the principle of sewage treatment of a mechanical sewage treatment plant.

Dengan bantuan carta alir proses, huraikan prinsip penyucian kumbahan loji rawatan mekanikal.

(15 marks/ *markah*)

(20 marks/*markah*)

2. Using the data and formula given, calculate the surface water flowrate from the catchment areas of the surface water drainage in **Diagram 1**. Calculate also the drainage flowrate to determine whether it can convey the surface runoff produced. Use **Table 1** for your answers and submit together with the answer scripts.

Formula

(a) $V = 0.33\ d^{2/3}\ s^{1/2}$

where : V - flow velocity (m/sec)
d - pipe diameter (mm)
s - slope (m/m)

(b) $i = \frac{760}{t + 10}$

Where : i - rainfall intensity (mm/hr)
t - rainfall duration (minute)

(c) $Q = 10^{-3}\ iA$

where : Q - surface runoff flowrate (m^3/hr)
i - rainfall intensity (mm/hr)
A - catchment area (m^2)

(d) Time of entry = 3 minutes

....3/-

Dengan menggunakan data dan rumus yang diberikan, kira kadar aliran air larian permukaan daripada kawasan tadahan sistem perparitan air permukaan di ***Rajah 1****. Kira juga kadar aliran perparitan untuk menentukan sama ada ianya berupaya menyalurkan air larian yang terhasil. Guna* ***Jadual 1*** *yang dilampirkan untuk jawapan anda dan serahkan bersama skrip jawapan anda.*

Rumus

(a) $V = 0.33\, d^{2/3}\, s^{1/2}$

di sini: V - *halaju aliran (m/saat)*
d - *garispusat paip (mm)*
s - *cerun (m/m)*

(b) $i = \dfrac{760}{t + 10}$

di sini: i - *keamatan hujan (mm/jam)*
t - *jangka masa hujan (minit)*

(c) $Q = 10^{-3}\, iA$

di sini: Q - *kadar aliran air larian (m^3/jam)*
i - *keamatan hujan (mm/jam)*
A - *luas kawasan tadahan (m^2)*

(d) *Masa kemasukan = 3 minit*

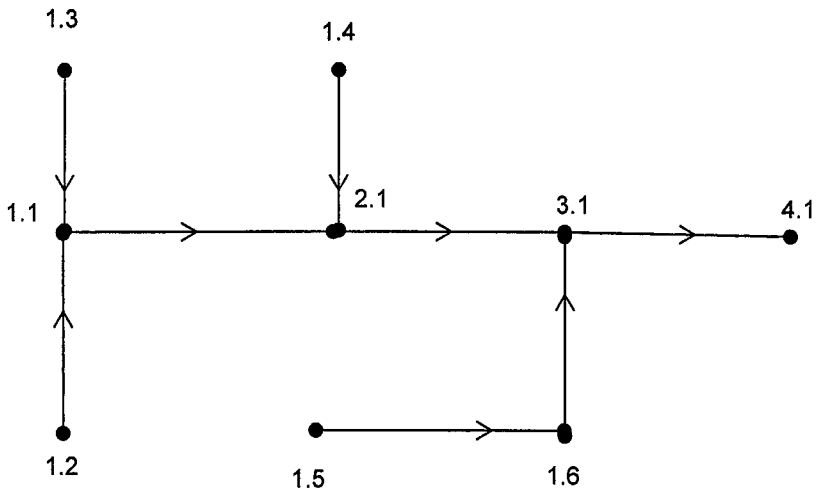


Diagram 1 (*Rajah 1*)

(20 marks/*markah*)

...4/-

3. (a) You are assigned to plan the water reticulation system of a proposed mixed residential development. Discuss the steps that you have to consider in order to decide whether an elevated water tower is needed or not.

Anda ditugaskan untuk merancang satu skim bekalan air untuk satu cadangan pembangunan residensi bercampur. Bincangkan langkah-langkah yang anda perlu ambil untuk menentukan sama ada tangki air menara diperlukan atau tidak.

(10 marks/ *markah*)

(b) In the event an elevated water tower is needed, discuss with the aid of sketches, the best location to site the tower from the **differential pressure needs** point of view.

Sekiranya tangki air menara diperlukan, bincangkan dengan bantuan lakaran , tapak terbaik untuk melokasikan menara teresebut dari sudut ***keperluan tekanan yang berbeza.***

(10 marks/ *markah*)

4. (a) Define "power" and "energy".

(2 marks)

(b) One 50 W lamp and one 100 W lamp are plugged into a 240 V circuit. These two lamps are connected in parallel. Calculate:

(i) the current flow through each lamp

(ii) the total current in the circuit

(iii) the total resistance in the circuit

(iv) the total energy consumed in a year if the lamps are used 10 hours a day and for 250 days per year

(v) the cost of electrical energy per year at an energy rate of RM0.218 per kWh.

(18 marks)

...5/-

(a) *Berikan definisi "kuasa" dan "tenaga".*

(2 markah)

(b) *Satu lampu 50 W dan satu 100 W disambungkan secara selari dalam satu litar 240 V. Kira:*

(i) arus yang mengalir melalui setiap lampu

(ii) jumlah arus dalam litar

(iii) jumlah rintangan dalam litar

(iv) jumlah tenaga digunakan setahun jika lampu-lampu berkenaan digunakan selama 10 jam sehari dan selama 250 hari dalam setahun

(v) kos tenaga elektrik setahun pada kadar tenaga RM0.218 per kWj.

(18 markah)

(20 marks/*markah*)

5. (a) Name the **TWO (2)** major advantages of an AC system over a DC system in building applications?

*Nyatakan **DUA (2)** kelebihan utama sistem AU berbanding sistem AT dalam aplikasi untuk bangunan?*

(2 marks/*markah*)

(b) What is the advantage of a three-phase power supply over a single-phase power supply?

Apakah kelebihan bekalan kuasa tiga fasa berbanding bekalan kuasa satu fasa?

(2 marks/*markah*)

(c) With the aid of sketches, discuss **THREE (3)** connection methods in the electricity transmission system

*Dengan bantuan lakaran, bincangkan **TIGA (3)** kaedah sambungan dalam sistem penghantaran elektrik.*

(16 marks/*markah*)

(20 marks/*markah*)

...6/-

6. (a) What is "power quality" in electricity supply? Name **FOUR (4)** causes of power quality.

*Apakah "power quality" dalam bekalan elektrik? Nyatakan **EMPAT (4)** penyebab 'power quality".*

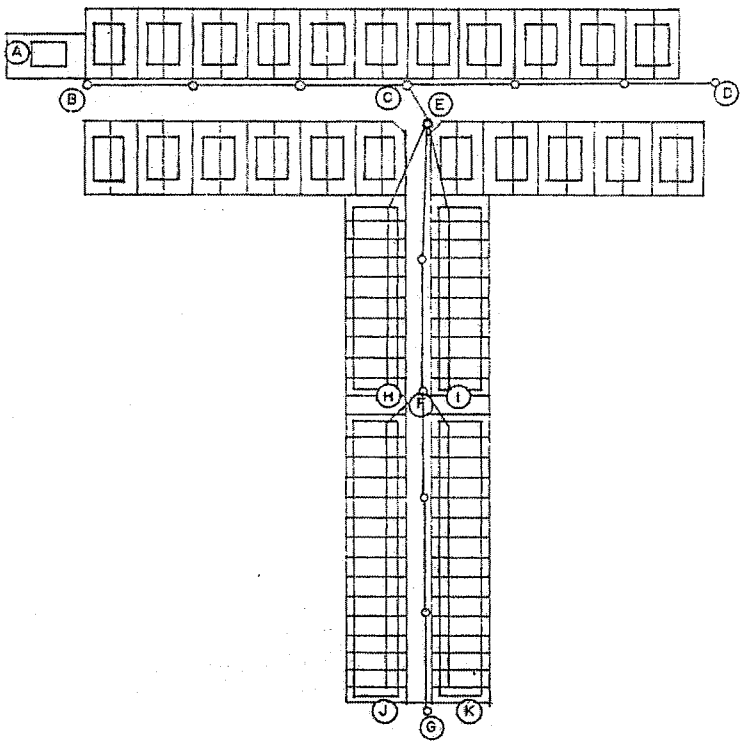
(5 marks/*markah*)

(b) The **Figure 2** below shows an area of semi-detached and terrace houses. The width of the streets in front of the semi-detached and the terrace units are 12m and 6m respectively. Refering to the details given and using the attached tables, calculate the voltage drop.

***Gambarajah 2** di bawah menunjukkan satu kawasan rumah berkembar dan rumah teres. Lebar jalan di hadapan rumah berkembar ialah 12m manakala lebar jalan di hadapan rumah teres ialah 6m. Berpandukan butiran yang diberi dalam jadual di bawah, kira kejatuhan voltan untuk kawasan perumahan ini dengan menggunakan jadual yang dilampirkan.*

(15 marks/*markah*)

Figure 2 ***(Gambarajah 2)***



...7/-

Section	Distance (m)	Mains
AB	25	185 mm^2 PILC Cable
BC	200	100 mm^2 Bare Aluminium Overhead Mains
CD	200	100 mm^2 Bare Aluminium Overhead Mains
CE	24	50 mm^2 Bare Aluminium Overhead Mains
EF	80	50 mm^2 Bare Aluminium Overhead Mains
FG	120	50 mm^2 Bare Aluminium Overhead Mains
EH	95	19/.064 5-Foot-Way Mains
EI	95	19/.064 5-Foot-Way Mains
FJ	150	19/.064 5-Foot-Way Mains
FK	150	19/.064 5-Foot-Way Mains

(20 marks/ *markah*)

...8/-

APPENDICES/*LAMPIRAN*

Percentage Volt Drop of Mains and Services

Types	Size	Percentage Volt Drop per kVA-km		Percentage Volt Drop per KE-km at 0.85 p.f.	
		3 Phase	1 Phase	3 Phase	1 Phase
L.V. Overhead Bare Aluminium Mains	25 mm²	0.734	4.40	0.864	5.18
	50 mm²	0.412	2.47	0.485	2.91
	100 mm²	0.241	1.45	0.284	1.71
Insulated Aerial Cables (AMKA-T)	1 x 16 + 25 mm²	-	7.03	-	8.27
	3 x 16 + 25 mm²	1.18	-	1.39	-
	3 x 25 + 25 mm²	0.751	-	0.884	-
	3 x 35 + 25 mm²	0.552	-	0.649	-
	3 x 50 + 35 mm²	0.415	-	0.488	-
	3 x 70 + 50 mm²	0.296	-	0.348	-
	3 x 95 + 90 mm²	0.222	-	0.261	-
	3 x 120 + 70 mm²	0.182	-	0.214	-
PILC Underground Cables	25 mm²	0.765	-	0.9	-
	35 mm²	0.558	-	0.656	-
	70 mm²	0.296	-	0.348	-
	120 mm²	0.180	-	0.212	-
	185 mm²	0.125	-	0.147	-
	300 mm²	0.0853	-	0.100	-
PVC 5-Foot-Way Services	7/.044	2.68	15.6	3.15	18.4
	7/.083	0.838	4.86	0.986	5.72
	19/.064	0.570	3.47	0.671	4.08
	19/.083	0.335	2.08	3.99	2.45
	7/.173	0.201	1.30	0.236	1.53

...9/-

No. Angka Giliran : _____

Section	Number of Consumers	Conductor size	% Volt Drop Per kW Per 1000 m	Route Length in km		ADMD Per Consumer	ADMD of Consumer in Section	ADMD of Consumers Beyond Section	Section % Volt Drop (4x6x8) + (4x5x9)	Cumulative % Volt Drop	Network Point
				Actual	Equivalent Route Length						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

Note: Use this table to answer **Question 6** and to be submitted together with your answer script
*Nota: Gunakan jadual ini untuk menjawab **Soalan 6** dan diserahkan bersama buku jawapan*

No. Angka Giliran : _____

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TABLE 1 (*JADUAL 1*)

Reference *Rujukan*	Catchment Area *Luas Kawasan Tadahan*	Cumulative Catchment Area *Kumulatif Luas Kawasan Tadahan*	Slope *Cerun*	Diameter *Garispusat*	Velocity *Halaju*	Pipe Capacity *Keupayaan Paip*	Pipe Length *Panjang Paip*	Flow Time *Masa Aliran*	Concentration Time *Masa Tumpuan*	Rainfall Intensity *Keamatan Hujan*	Surface Runoff Flowrate *Kadar Aliran Air Larian*
	m^2	m^2	m/m	*mm*	m/saat	m^3/jam	m	minit	minit	mm/jam	m^3/jam
1.2 – 1.1	700		1/100	*150*			150				
1.3 – 1.1	600		1/100	*150*			150				
1.1 – 2.1	600		1/100	*200*			150				
1.4 – 2.1	500		1/100	*150*			150				
2.1 – 3.1	600		1/100	*200*			150				
1.5 – 1.6	500		1/100	*150*			150				
1.6 – 3.1	600		1/100	*150*			150				
3.1 – 4.1	700		1/100	*250*			200				

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